UPPSALA
UNIVERSITET

Environmental auditing of the forest company La Chonta Ltd., Bolivia

— Audiatoria ambiental de la empresa forestal La Chonta Ltd:a

Santa Cruz de la Sierra, Bolivia 2000

Ylva Svensson

Arbetsgruppen för Tropisk Ekologi
Committee of Tropical Ecology
Uppsala University, Sweden

Minor Field Study 103

April 2004 Uppsala

UPPSALA
UNIVERSITET

Environmental auditing of the forest company La Chonta Ltd., Bolivia

— Audiatoria ambiental de la empresa forestal La Chonta Ltd:a
Santa Cruz de la Sierra, Bolivia 2000

Ylva Svensson

Cover picture: A huge log of a softwood species (ochoo or bibosi) is being sawn in the sawmill at La Chonta. The number painted on its end is a marking for the chain of custody. Photo: Ylva Svensson

Department of Earth Sciences/Environment and Landscape Dynamics
Uppsala University, Sweden
Supervisors:
Prof. Lennart Strömqvist, Department of Earth Sciences/Applied Environmental Impact Assessment, Uppsala University, Sweden.
Lars-Gunnar Marklund, Scandiaconsult Natura, Sweden; chief tecnical adviser, Promabosque, Bolivia.

Table of Content

Abstract
Breve Resumen en Español
Keywords
1. Introduction
1.1 Justification of the Study
1.2 Objectives and Delimitations of the Study
1.3 Material and Methods
2. Background
2.1 Forest Certification
2.2 The ISO 14 000 standards
2.3 Forest Stewardship Council
2.4 The forest situation in Bolivia
2.5 Forest Certification in Bolivia
2.6 Legal Framework on Environmental Issues in Bolivia
3. La Chonta
3.1 General Description of the forest company La Chonta
3.2 Management of Forests
3.3 Forest Research
3.4 The Sawmill at La Chonta
3.5 The Carpentry in Santa Cruz
3.6 Legislation
4. Impacts
4.1 Impacts from Forestry
4.1.1 Impacts on Soil, Water and Air
4.1.2 Impacts on Flora, Fauna and Biodiversity
4.1.3 Socio-economic Impacts
4.2 Impacts from the Sawmill
4.2.1 Impacts on Soil, Water and Air
4.2.2 Impacts on Flora, Fauna and Biodiversity
4.2.3 Health of Neighbours
4.2.4 Handling of Chemicals and Combustibles
4.2.5 Labour Environment and Industrial Security
4.3 Impacts from the Carpentry
4.3.1 Impacts on Soil, Water and Air
4.3.2 Health of Neighbours
4.3.3 Handling of Chemicals and Combustibles
4.3.4 Labour Environment and Industrial Security
5. Discussion
5.1 Environmental Considerations
5.2 Capacitating
5.3 Conclusions and Recommendations
5.3.1 Forest
5.3.2 Sawmill
5.3.3 Carpentry
5.3.4 Organisation
6. Acknowledgements
7. References
Annex 1: Acronyms and Abbreviations
Annex 2: List of tree species mentioned in the study
Annex 3: Resumen ejecutivo en Español

Abstract

The Bolivian forest company La Chonta Ltd. has undergone an environmental certification by FSC, the Forest Stewardship Council, and now aims to also attain certification by ISO 14 000. The company has two forest concessions with a sawmill at each site, and a carpentry in Santa Cruz. The silviculture is carried on with several mitigation measures to minimize the disturbance on the ecosystem. The industrial plants have some environmentally unfavourable routines, mainly handling of wastes. The production could be made more effective, and the yield could be increased, and environmental impacts could thus be reduced. An reorganisation is planned, where wood residues will be burnt for energy. The company might, as a first step towards a certification by ISO 14 000, formulate an Environmental Management System, and run this system in order to develop it.

Breve Resumen en Español

La empresa forestal La Chonta Ltd:a ha recibido una certificación ambiental de FSC, y ahora intende de tambien tener certificacion de ISO 14 000. La empresa tiene dos concesiónes con aserraderos, y una carpinteria en Santa Cruz. En la silvicultura aplican varios medidas de mitigación para minimizar el impacto al ecosistema. Las plantas industriales tienen algunas routinas desventajosas para el medio ambiente, principalmente el manejo de basura. La producción podria ser effectivizada, y el rendimiento mejorado, y impactos ambientales entonces reducidos. Una reorganisación esta planificada, y residuos maderables seran quemados por energia. La empresa podria, como su primer paso hasta la certificación ambiental de ISO 14 000, elaborar un Sistema de Gestion Ambiental, y aplicar este sistema para desarollarlo.

Keywords

Bolivia, Environment, EIA, Tropical Forest, Forestry, Forest Certification, Wood Industry

1. Introduction

1.1 Justification of the study

Environmental sustainability is an issue of increasing global concern. Management of natural resources, as well as impacts from human activity and the sustainability of these activities, are in the focus of interest. The forest makes an important natural resource for a tropical country like Bolivia, which is in the beginning of its industrialization. It is of crucial importance for every developing country that its economic development is congruent with environmental sustainability.

The Swedish International Development Agency (Sida) is financing a Forestry Development Programme in Bolivia. Sida has decided upon an environmental policy of which Environmental Impact Assessment for different levels of implementation forms an integral part. This study, which is carried out as a Minor Field Study (MFS) financed by Sida, and will be a thesis in Applied EIA Studies, takes part within the Programme, and is performed on one of the forest companies that are getting technical assistance from the Programme. The study could be a model for assessment of forestry on a single-project level, within the program for development of forestry in Bolivia.

1.2 Objectives and Delimitations of the Study

Environmental issues are connected to a wide range of different sciences. The intention of this audit is to provide a survey of relevant scientific and technical areas, which could be the focus of further investigations to achieve environmental improvement, and reduce negative environmental impacts of the company's production activities. The audit includes environmental impacts from the industry plants, as well as effects of resource management such as choice of tree species, logging methods and transports.

The fieldwork in Santa Cruz was carried out between 28 Aug. and 20 Nov. 2000. The study deals mainly with environmental impacts from the sawmill and carpentry, not from the forestry which already is certified in accordance to FSC criteria, and also not much with the production activity relative to the legal framework of Bolivia, because the FSC certification already demands compliance with the laws.

1.3 Material and Methods

Literature studies were carried out on EIA books, Sida guidelines and checklists for EIA, FSC and ISO certification directives, Bolivian legislation documents, earlier performed studies and investigations on La Chonta, Bolivian forestry and certification. Field visits were made to the forest production site and sawmill at La Chonta, and the carpentry in Santa Cruz. Interviews were conducted with the directors of La Chonta, with staff at Promabosque, the forestry and the environmental ministries of Bolivia, and the local Sida office at La Paz. The interviews with the administrators of La Chonta were carried out as in the model for EMSs, where each subdivision of the company is encouraged to identify problems and suggest solutions. The environmental situation at the company was finally compared with the EIA checklists.

2. Background

2.1 Forest Certification

Forest certification is a formal, voluntary procedure. A certifier, who is a third-party inspector, gives a written assurance that the quality of forest management conforms to specified standards. This certification is often followed by verification of a chain of custody of the products. In this way, certification attempts to link market demands for forest products produced to high environmental and social standards with producers who can meet such demands. However, there is very little monitoring and assessment of the impact on forests, people and trade of certification. (Bass, 1998)

There are two complementary types of standards. Performance standards cover operations and their impacts, while process/ management systems standards cover enterprise policies, management systems and processes. Environmental/ social NGO:s and those buyers promoting "green" or "fair trade" forest products would like to see the achievement of very high performance standards, particularly as defined by the Forest Stewardship Council. Big forestry business tends to stress the need for process over performance, stating that all forests and enterprises are different and that it is appropriate to force a single set of performance targets on all enterprises irrespective of their starting points and capacities. They like the ISO 14 000 Environmental Management System for this reason. Sustainable forest management might best be achieved by a mix of both process and performance standards. (Bass, 1998)

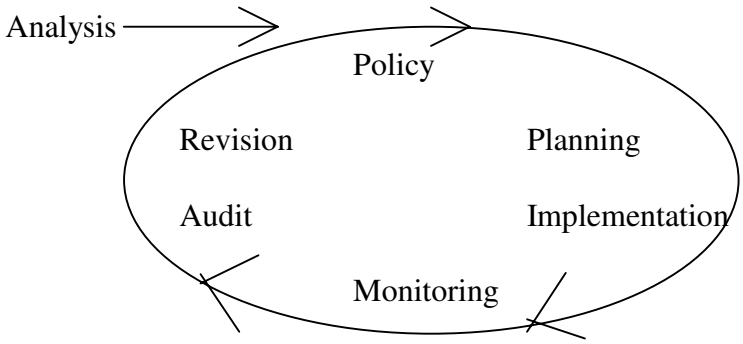
2.2 The ISO 14 000 standards

The International Organisation for Standardization, ISO, has a long experience of standardisation work. Through its ISO 14 000 series, the ISO offers a framework for the certification of Environmental Management Systems (EMSs). This series does not specify forest management performance standards, and does not permit a label to be attached to products. The EMS is certified, rather than the forest. ISO approaches are understood by producers, some large corporate buyers and most government bodies, who have used them in many aspects of their work. ISO has been in business since 1947, originally focusing on technical standards for products. More recently it has moved to production processes, notably ISO 9 000 over quality management systems and ISO 14 000 over EMSs. The concept of continuous improvement is central; an enterprise sets targets incrementally, in order to meet them, learn from them, and set increasingly more ambitious goals. ISO process standards encourage the use of the standard as an internal management tool, with first-party assessment, but this cannot be used as a claim for market purposes. Third-party certification is optional, but cannot be used for making specific environmental claims and for labelling products, but can be used for general publicity. (Bass, 1998)

The international ISO organisation consists of its national members. The Bolivian standardisation organisation IBNORCA has worked with ISO 9 000 for about 10 years, but not yet with ISO 14 000. If some company asks for ISO 14 000 certification, they could probably work out a certification model, or let a foreign company do the certification. (D. Matkovic, pers. comm.)

The chief document of the ISO 14 000 series is the ISO 14 001: “Environmental Management Systems - specification with guidance for use”. It is only possible to be certified in accordance to this document; all other documents in the ISO 14 000 series are just guideline papers. The ISO 14 004: “Environmental Management Systems - general guidelines on principles, systems and supporting techniques” provides a background about what EMS is, and how it could be useful for companies who want to improve their systems. There are also other documents in the ISO 14 000 series, which offer guidance on more specified issues, like the ISO 14 016 on forestry. When it comes to forestry practice, the ISO refers to management specifications elaborated by FSC and other forestry organisations. (ISO, http://www.iso.ch)

The process standards set by the ISO, include the cycle of continuous improvement, which is fundamental for the EMS, and consists of the following parts:



- The analysis includes identification of environmental aspects and impacts, and delimitations about which impacts are possible for the company to control, depending on which production stages they control.
- The environmental policy document should contain commitments to comply with relevant environmental legislation and regulations, and other demands on the company, as well as the commitment of continuous improvement and prevention of pollution.
- In the planning phase, the goals and priorities for the environmental work are set, and an EMS program is formulated for organization of the work and specifications of who will do what, when, how, and to which cost, which education is needed, and how the internal communication should be handled.
- Implementation means procedures for realization of the plans.
- The control includes monitoring, evaluation and documentation of the activities, handling of unusual events and correction routines.
- The audit is the tool to check the outturn of the environmental work, and to evaluate if the EMS is suitable for the company, if it is adequate and effective.
- Revision and correction of the EMS and its routines, and further raising of the goals.
- And then the cycle starts over again...

(Marcus, 1998)

2.3 Forest Stewardship Council

The Forest Stewardship Council (FSC) is a Mexico-based international organisation that, in contrast to ISO, is new. It was established precisely for the purpose of forest certification, and it was designed specially to deal with contemporary forest problems, and with environmental problems in particular. Many NGOs have experimented with boycotts and advocated bans, but

came to see that positive discrimination might be more effective. FSC operates a complete package: a global set of 10 Principles and Criteria for good forest stewardship; an international accreditation programme for certifiers; a trademark that can be used in labelling products from certified forests; and a communication/ advocacy programme. (Bass, 1998)

The primary activity of the FSC is accrediting and monitoring the certifiers that actually evaluate logging companies. In addition, FSC approves locally developed standards that specify regional or national certification thresholds, and provides a forum for conflict resolution. Certification is completely voluntary, and is initiated by the forest company seeking certification. An expert team makes a field evaluation of the forestry. If FSC-approved regional or national standards exist, the certifier has to use them, otherwise in-house standards are used. If the certification team judges that the forest enterprise lives up to the relevant criteria, certification is granted. In many cases the certification team proposes improvements in the management scheme, and certification is conditional on compliance. Certificates generally last for five years, and require annual audits by the certifier. (Darby, 1998)

2.4 The forest situation in Bolivia

Bolivia has large forest resources; almost half of its area is covered by forest. About 30%, 15 million hectares, are suitable for forest production. At this moment, about 6 million hectares have forest management plans. The forest production could increase by a factor of 5 in terms of volume and by a factor of 10 in terms of value, without compromising sustainability. Bolivia has probably the most modern and advanced forest legislation among tropical countries. Forest certification was introduced at an early stage and today more than 660,000 hectares of forests are certified. The certified companies produce about 50,000 m^2 sawn wood yearly, and could produce substantially more, but at present the tree species are relatively new and unknown to the international market (Sjödin 2000). The main disadvantage for the forest sector is a high production cost, causing difficulties to compete on international markets. Transport cost is high due to long distances and bad infrastructure, and sawmills use old technologies and inefficient production processes, which also raise costs. In order to help Bolivia's forest industry to develop into an efficient and internationally competitive industry, Sida and CFB, Cámara Forestal de Bolivia (the Forestry Chamber of Bolivia) signed an agreement for a five-year (1997-2001) technical co-operation program. CFB and its technical branch Promabosque implement the Programme, with technical assistance from the Swedish consulting company SCC Natura. The project activities are implemented on a group of “model companies”, in order to assist in the development of some good examples, which will encourage other companies to follow. The companies receive an integrated technical assistance in many aspects, ranging from business strategy development, sustainable forest management including low impact logging and forest certification, improvements of the industry processing facilities, and marketing and sales of the wood products. (Sida & Cámara Forestal de Bolivia, 1997)

The forestry sector of Bolivia is facing bad times, the sawmills are only working at 10-20% of their capacity. There is no demand for the products, the local market cannot afford them, and Argentina which earlier bought much second-rate wood, now instead buys it from Brazil. (T. Sjödin, pers. comm.)

The direct environmental impact of traditional logging practices is relatively low, due to the fact that typically only one or two large, valuable trees are harvested per hectare. Historically, mahogany (*Swietenia macrophylla*) and to a lesser extent, cedar (*Cedrela odorata*) and roble (*Amburana cearensis*) have been the target of most logging activity in Bolivia. By robbing the forest of future economical value and by leaving behind a network of roads, unsustainable selective logging opens the way for the farmers and ranchers who actually clear the forest. Sustainable forestry generally requires leaving economically valuable timber in the forest, both seed trees to promote regeneration, and by respecting minimum cutting diameters. These productive forests will hopefully be more immune to land-use change, due to the managers' incentive to protect their future harvests. The key to sustainable forest management is to cut no more than the forest produces, and to make sure that harvesting does not alter the biological composition and physical structure of the forest. However, the long-term ecological ramifications of even sustainable forest management are largely unknown, particularly in tropical forests. (Darby, 1998)

2. 5 Forest Certification in Bolivia

Bolivia is the first non-European country to develop a set of national certification criteria in accordance with FSC, and is one of the few tropical countries to have an active national certifier. National standards are sensitive to local social, economic and ecological realities. Cimar/SmartWood is a result of an alliance between the USA based certifier SmartWood and the university-affiliated Bolivian organisation Cimar (Centre of Investigation and Management of Renewable Natural Resources). Cimar is the Bolivian representative of SmartWood, and this in-country capacity reduces the cost of certification, and acts as a local bank of knowledge, both of information to enterprises undergoing certification and in various workshops for other stakeholders. The link to a foreign organisation also lends Cimar a higher level of credibility. (Darby, 1998)

A disadvantage is that SmartWood practically has a monopoly on certification, other certifyers have tried to get into the market but it is difficult while SmartWood isn't a profit making organization. The certification initially costs 20-30 000 US$, and thereafter there are the costs for yearly controls. (N.
Häger, pers. comm.)

Certification in Bolivia has received indirect support from the new forestry law, and a significant backing from an array of institutions. Additional reasons are dwindling stocks of target species, new regulations and government programmes designed to promote sustainable forestry, and international market pressure. In 1996, the Bolivian congress passed a new forestry law. Article One states that the objective of the new law is to enforce the sustainable use and the protection of forests for the benefit of present and future generations, thereby harmonising the social, economic, and ecological interests of the nation (Bolfor 1996). The new law requires that all logging enterprises develop management plans that include a clear, solid and explicit strategy guaranteeing the long-term sustainability of both volume and quality. The actual forestry practices designed to meet the sweeping goals of the new forestry law are presented in a series of technical norms issued by the Ministry of Sustainable Development and Environment, MDSMA. A key component of the new forestry law is the creation of an independent institution, the Forestry Supervision Agency, empowered to monitor and enforce compliance with the law. The forestry law has promoted certification

primary by demanding the same thing as the national standards. Certification is therefore a relatively small step for law-abiding companies. In addition, the law dictates a shift from volume-based to area-based taxes, and has given rise to a set of technical norms that prohibit unsustainable selective logging, which forces firms to harvest a much broader range of species than before. The companies increasingly see certification as an important strategy for developing markets for these new species. Bolfor, a joint project between MDSMA, USA's aid program USAID and some pivate sector organisations, has been working with the forestry law, promoting the formation of the Bolivian Council of Voluntary Forest Certification CFV, harmonising the law and the national standards, providing technical assistance to firms, developing marketing networks, and lending credibility to the certification system among national actors. CFV provided an institutional platform for the development of national standards for wood certification, and served as an information clearinghouse by organising workshops about certification. Working on national standards was an important mechanism for cultivating the support of logging companies, local communities and environmental advocates. The process itself provided an important space for normally divergent interests to achieve consensus about the best use of the forest resources of Bolivia. (Darby, 1998)

2.6 Legal Framework on Environmental Issues in Bolivia

In most recent years, a consciousness about environmental issues has begun to arise in Bolivia. In 1974 a Center of Forestry Development was created, in 1988 the Subsecretariate of Environment and Renewable Resources, SMARR, was established, and in 1990 FNMA, the National Fund for the Environment, an institution which deals with environmental projects, was created. In 1991 came a Decree on an ecological moratorium in the forestry sector, in 1992 came the Environmental Law, that states protection and conservation of the environment and a sustainable development, and in 1995 came the Regulation of the Environmental Law, concerning EMS, Environmental preventing and control, Atmospheric contamination, Water contamination, Handling of dangerous substances, and Solid wastes. The institution occupied with EMSs is MDSMA, who via SNRNMA, National Secretariate of National Resources and Environment, established a series of directives for environmental management. (Castro & Veliz, 1999)

Several laws deal with the environment: The Law 1493 about Ministries of Executive Power, the Law 1654 about Administrative Decentralization, the Law 1551 on Popaular Participation and Civil Society, the Law 1333 on Environment, and the Forestry Law, the Law about Land and Land Rights and the Law on Biodiversity. Of these laws, only the environmental law is applicable on environmental management. This is carried out via the Environmental Registration (Ficha), which is an instrument to decide which category of EIA is needed for the applying enterprise. The categories are:
Category I: needs an entire EIA analysis.
Category II: needs a partial EIA analysis.
Category III: does not need a partial EIA analysis.
Category IV: does neither need a partial EIA analysis nor mitigation measures.
The institutions in charge of the environmental management at the national level are the Ministry MDSMA, its Secretariate SNRNMA and the Subsecretariate SMARR, and at department level it is the Prefectory of Department, PD. (Castro & Veliz, 1999)

The environmental law of Bolivia is good in theory, but it does not function. It is a framework law and says practically nothing, all specifications are found in its regulation, and this is not yet applicable because it still lacks instruments to enforce obedience. The regulation, which is complicated and non-functional, is under revision. MDSMA are to supervise the other ministries on obedience with the law, but are not doing it for lack of resources. The PD have several laws to supervise, for example the law on taxes and the law on trade, and the environmental law, that is not of their greatest priority. EIA is to be done on all new establishments, while existing enterprises have to fill up a registration form (Ficha Ambiental) about their environmental impact, that is signed by someone who is licensed by MSDMA. (J. Avila, pers. comm.)

The forestry law is supervised by the Superintendencia Forestal, SF, and is almost completely applied in the country. Environmental goals shall be included in the forest management plan, according to the forestry law (J. Avila, pers. comm.). The forest is the property of the Bolivian State, and the State issues concessions, which is cutting rights over a certain range of years, to the forestry companies. The enterprises have to pay an area-based tax for their concessions. But many of them don't pay it because they cannot afford to. And SF cannot deprive them of the concessions, which it should do, because the agency is economically dependent on the forestry industry (L.-G. Marklund, pers. comm.). The changed tax system in the new forestry law is anyhow an incentive for the companies to seek out a broader range of tree species to harvest. When the tax is paid by hectare and not by m^3 extracted wood as before, it is no longer possible to search enormous areas for the increasingly more rare mahogany. (N. Häger, pers. comm.)

There is a considerable discrepancy between intentions and reality. The new environmental law will be implemented 2001, but has been published in advance so the enterprises have had several years to adapt, but nothing has been done yet. (A. Nilsson, pers. comm.) The regulation of the environmental law does not work, because it is too ambitious (I. Vranjican, pers. comm.). The regulation is to be adapted to the reality, and is now undergoing a reformation, supported by the Danish aid programme PCDSMA. (B. Hermind, pers. comm.)

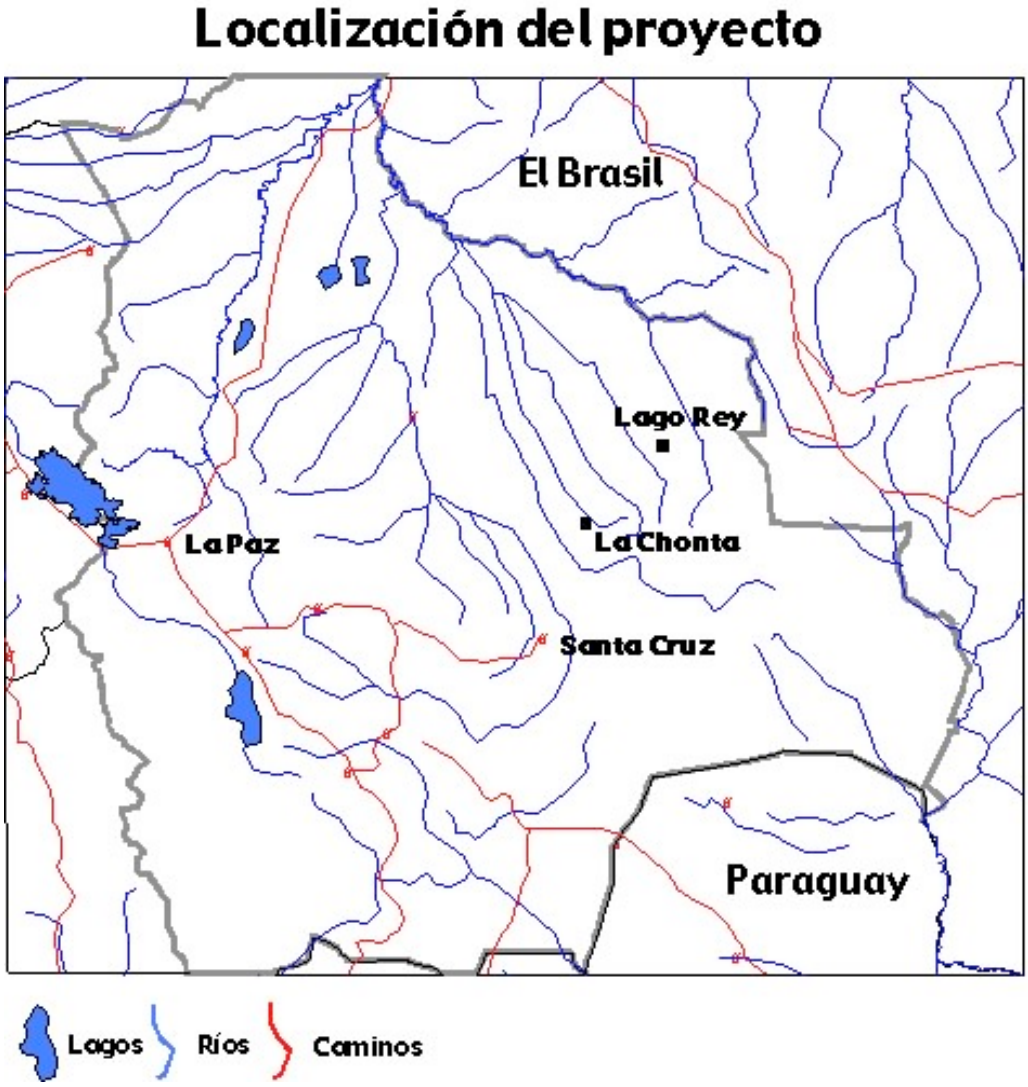
MDSMA are working on the issue of public environmental awareness. They demand that environmental consideration enters into all kind of activities. The education of people will take a long time, a general acceptance of the importance of environmental issues is necessary. The Industry Chamber, CAINCO, has an Environmental Department, and it works in collaboration with UPSA with education in environmental management. They use the ISO 14 000 model, but do not seek certification, which is considered to be too costly. (I. Vranjican, pers. comm.)

3. La Chonta

3.1 General Description of the forest company La Chonta

The forest company La Chonta is one of the progressive “model” companies that are getting technical assistance within the Sida development program. La Chonta works with cutting and processing of forest products. It runs a carpentry in Santa Cruz and has two forest concessions with a sawmill at each site. Concession La Chonta is situated 300 km from Santa Cruz and Lago Rey 600 km. The carpentry mainly produces doors and floors for export; these are shipped to the USA via Arica, Chile. (SmartWood 2000, La Chonta 2000)

The administrators of La Chonta are the general director Pablo Antelo, the responsible officer of forest activities Roberto Quevedo, the responsible officer of energy and drying chambers German Tabura, and the responsible officer of carpentry Roberto Patzi. The directors of La Chonta have high ambitions concerning environmental issues. The company is certified in all of its activities by FSC. Lago Rey was certified in 1997, La Chonta in 1998 and the carpentry in Santa Cruz in 1999. FSC makes visits for revision each year. The directors of La Chonta intend also to achieve ISO-certification for the company in the future. (P. Antelo, pers. comm.)



Lago Rey has been harvested for 17 years, La Chonta for more than 25 years. A structural change occurred as a result of the new forestry law 1996. The cutting permission was turned in 1997 into a concession for 40 years, prolongable for 5 years at a time for 40 years further. There is no decision what will happen after 40 + 40 years when the concession runs out (R. Quevedo, pers. comm.). (SmartWood, 2000)

3.2 Management of Forests

The concession La Chonta consists of 100 000 hectares, whereof 13% dense forest, 50% intermediate, and 36% thin forest that have burned. Cattle raising is a threat to the forest because the peasants burn-beat the grazing lands, which often results in uncontrolled fires. A program to control forest fires is being elaborated. The forest guards of the Forestry Supervision Agency are capacitating themselves in making fire breaks in the forest, and are going to teach the neighbours not to burn in an uncontrolled way. It is also the responsibility of the Forestry Supervision Agency to supervise and prevent illegal cutting and theft of trees. There are burnt areas around La Chonta, and 13 million hectares were burnt in 1999. In 1995 there was a forest fire in La Chonta, and this is now an area of protection and regeneration. In the area of regeneration, all the trees were killed, but in the area of protection the fire was not that severe, and some of the big trees have survived. The forest at La Chonta is a humid subtropical forest with a mean temperature of 25,3°C, and a mean precipitation of 1562 mm/year. June to August is a dry season with cold winds. Watercourses are the system of Rio Blanco and Rio Negro with their feeder streams. A village with indigenous population is situated nearby, and sometimes colonists try to invade the area. The composition of the tree species according to market value are 2% very valuable species (mahogany, *Swietenia macrophylla*), 4% valuable, 39% with low value and 55% without commercial value. At present the species that are cut are ochoó (*Hura crepitans*), bibosi (*Ficus* sp.), yesquero (*Cariniana estrellensis*), ocorocillo, serebó (*Schizolobium amazonicum*) and verdolago (*Terminalia oblonga*). Through investigations and promotion it would be possible to increase the amount of marketable species. The concession Lago Rey consists of 120 000 hectares, whereof 77% is productive forest. Species that are cut are cambará (*Erisma uncinatum*), bibosi (*Ficus* sp.), sauco (*Zanthoxylum* sp.) and paquió (*Hymenaea courbaril*). The forest is a humid lowland forest with a mean temperature of 24-25°C and a mean precipitation of 1500-2000 mm/year. July to August is the dry season. (SmartWood, 2000)

The officer responsible for the forest, R. Quevedo, has written a Forest Management Plan for each concession, and writes an Operative Plan at the beginning of each year, which describes the planned activities for the next year. It includes volumes counted by the censusing team, marking of harvestable trees and seed trees, instructions about harvesting techniques that minimize the impacts, such as directed felling and trailing of logs with a winch that lifts up the end of the log behind the skidder to minimize damage of the soil. It also contains guidelines for construction of roads, how to avoid erosion by avoiding steep slopes and construct drainage systems, and planning of the secondary road network to avoid the constructing of unnecessary road sections. The trees are trailed about 1 000 m, which reduces the need of primary roads by half (50%). It also includes future improvements of the sawmill: better lodging, increased drying capacity, improved flow of material in the sawmill, development of alternative treatments for wood to avoid the need of using biocides, changing the diesel generator for a vapour turbine generator that uses biofuel, and implementing of the labour safety recommendations. In the area of protection and area of regeneration which have

been affected by forest fire, nothing is done right now. Investigations will be undertaken of what could be done, maybe plantations or enrichment with mahogany. (R. Quevedo, 1998 & 2000)

The silviculture is carried on with the ambition to disturb the ecosystem as little as possible. The concessions are situated in areas with virgin forest, but has been used for several years. The company practices low impact logging. Non-commercial species are totally left in the forest. About 3 trees/hectare are felled, the logs are brought out along trail pists with skidders to the heads of the motorable tracks, where they are cut into pieces and loaded on lorries to be taken to the sawmill. The felling team practises directed cutting, in order to minimize the damage on surrounding trees that are left on root. Before felling, lianas are weeded to make it easier to direct falling trees and avoid damage and accidents. Water courses are protected and no trees are felled in a protection zone of 10 m on each side of them. Residues from the felling are not to be left in the water. A cycle of cutting is estimated to 30 years. The forest is divided into 30 blocks of equal size, which are logged one each year. The forest consists of a rich blend of species whereof about 10 are at present considered as commercially interesting and are harvested. 20% of the mature trees of the utilized species are always left as seed trees; they will probably be cut the next cycle of cutting. The Forestry law protects young trees, it permits cutting of trees from a diameter at breast height more than 50 cm for small species like yesquero blanco and ocorocillo, or 70 cm for big species like ochoó (*Hura crepitans*) and bibosi (*Ficus* sp.). La Chonta demands cutting diameters of 60 respective 80 cm, because bigger trees have higher density in the wood and thus a significantly better quality. Branches with a diameter more than 30 cm and at least 2 m long are also harvested. Only the heart wood is used, the outer wood is too soft. Softwoods grow about 1 cm/ year, hardwoods less, and they never reach the same diameters. Paquió (*Hymenaea courbaril*) could be some 2-300 years when a metre in diameter. The exact age is unknown, and neither is it known to which age the trees can reach if just left to grow. (R. Quevedo, pers. comm.)

3.3 Forest Research

Very little is known about the tropical ecosystem. Harvesting could change the composition of species, and measures to avoid that is, for instance, to leave seed trees, and try to protect small trees of preferable species during logging. At present, no other silvicultural operations are made besides weeding of lianas and logging. There will be investigations about which other operations are the best to do. The ecologist Lincoln Quevedo is working on a Ph.D. in forest research at the University of Florida, and will have three long term research sites for studies of forest under harvesting. One site will be in humid rainforest, the other in dry forest and the third in an intermediate location, whithin concession La Chonta, the only site so far that is settled. A description of the intended research site can be found in the Operative Plan for Concession La Chonta. The investigation intends to give more information about an ecosystem under harvesting. The research started in August 2000, and will continue for two years. The results can maybe improve the growth and harvesting model of Bolfor, COSECHA, which at present is not at all adapted to the forest in this region. It is necessary with models to predict the effects on the forest in the long run, to ensure that the forest still produces after 30 years and even more and hopefully produces better than now. The investigation will be about different silvicultural operations and how the forest reacts, as for example concerning forest growth, and how it is affected by the silvicultural activities such as cutting of lianas, thinning operations, harvesting of trees, and perhaps plantation of mahogany where bibosi is cut.

Bibosi has large crowns and one tree leaves a big open space when cut. Mahogany needs much light for its regeneration, and the maintaining of young plants is difficult. Earlier only mahogany, roble, cedro and some paquió were cut. The quality of the forest is the same, besides the reduction of these species, and thus La Chonta decided on a moratorium of cutting these species. Paquió is not that reduced, and it is still cut. Enrichment with mahogany would be a way to increase the value of the forest. Enrichment is permitted in the forestry law, but plantation that replaces natural forest is not. The study would preferably be carried on for 40 years in a permanent research area, including investigations of flora, fauna, dynamics of the ecosystem and how different silvicultural operations affect the forest in the long run. (L. Quevedo, pers. comm.)

Some other research is also carried on in the area. The recommendations from Cimar is to cut branches of the tree residues left in the forest, to get a faster decomposition and thus improve the regeneration, and Bolfor is now making an investigation to see if this operation is necessary. Bolfor will also make an inventory of species at La Chonta when they have got funding for such a project. The university UPSA in Santa Cruz is connected to the University of Linköping, Sweden, to create a woodworking education. (R. Quevedo, pers. comm.)

3.4 The Sawmill at La Chonta

The sawmill at La Chonta is situated nearby a river, Rio Blanco. Rio Blanco runs along the western side of the area, and Rio Chico, a feeding stream to Rio Blanco, along the south. Both sides of the cape where the factory is situated are vulnerable to inundation. The dry season lasts 8 months/ year, but during 2 months/ year there can be inundations. About 20 administrators and subadministrators are working in boiler, dryers, stock, engineering plant, sawmill, and filing workshop, and about 50 -70 workers in the sawmill at La Chonta. The sawmill in Lago Rey has about the same capacity but is to be closed down during the reorganisation, while expanding the sawmill at La Chonta to its double capacity. The sawmill gets its electricity from a diesel generator, and in the reorganisation there are plans to exchange it for a vapour turbine fed with biofuel from the residues of the sawmill. In the sawmill, the existing line will be improved, and the new arrangement that will be built during 2001 is now designed. The expansion also includes more dryers, and automatization of the sawmill and the boiler. The new sawmill will be semi-automatized, which means faster flow of material, fewer workers to manage it, and less risk to make errors. Later a new sawmill will be built. The most preferable site for it is on a small hill, significantly better situated in relation to the river than the actual construction that is closer to the river and thus a shorter infiltration way for leach water entering the river, and which also is threatened by the risk of inundation (P. Thomsgård, pers. comm.). The main impacts from the sawmill are the wood residues and noise. The diesel generator makes rather much noise, mostly on the ranger area, but also at the lodgements nearest the river. It is run all the time, also in the nights when no turn is working at the sawmill. (G. Tabura, pers. comm.)

3.5 The Carpentry in Santa Cruz

The carpentry mainly produces doors. A small part of these, about 2%, are sold at the local market, painted or varnished, while the main part is exported to the USA, without surface treatment. The carpentry is situated in a building that has walls, in an industry zone of Santa

Cruz. The carpentry as well as the sawmill have wood dryers, and the wood residues are used to heat these. Almost all the wood is burned. The sawdust is collected in a silo and sold to make bricks. (R. Patzi, pers. comm.)

3.6 Legislation

The forestry law from 1996 demands a Forest Management Plan that includes environmental considerations. Certification implies supervision by Cimar of all the laws concerning the forest activities. The environmental, laboural and forest law are the principal laws. There are no severe contradictions between the environmental and the forestry law (J. Avila, pers. comm.). The environmental registration (Ficha Ambiental) is not needed for forestry activities according to the forestry law, and this could cause question of interpretation in some cases, but this doesn't concern La Chonta that also has industries, where the registration is necessary. La Chonta has applied for an environmental licence (Licencia Ambiental), but after that nothing more has happened. The administrators of La Chonta declare that they know the forestry law and the law of labour, but not much about the environmental law. The authorities perform a control of the industrial security once a year, but no control of environmental aspects. (P. Antelo & R. Patzi, pers. comm.)

The company has some problems with mine prospecting in the concession La Chonta, because the mining law has priority over the forestry law. The administrators of La Chonta do not know yet the results from the prospecting. They consider to apply themselves for the prospecting rights in the concession area, in order to exclude other prospectors and the threat of mining in the concession. Now some informal gold washing takes place in the area, and the Forestry Supervision Agency tries to get rid of this activity. (P. Antelo, pers. comm.)

4. Impacts

4.1 Impacts from Forestry

- Erosion along trail pists and roads
- Damage on surrounding trees during logging
- Habitat changes for flora and fauna
- Change in tree species composition
- Socioeconomical impacts on human inhabitants in the area

4.1.1 Impacts on Soil, Water and Air

The main impacts occur during the logging. The roads expose the soil, there are some minor problems with erosion along the road sides, and a mitigation measure would be to construct roads with better techniques. The erosion risk is small, the ground is flat and the trail pists are recovered fast with ground vegetation and also with new trees. Rio Blanco is not very sensible concerning erosion, and no logging is permitted near watercourses. The cutting itself is another impact; the trees could fall in another direction than the intended and damage surrounding trees. (R. Quevedo, pers. comm.)

4.1.2 Impacts on Flora, Fauna and Biodiversity

Some measures to decrease impacts that change the habitat have been undertaken. Hunting is prohibited for the employees of the enterprise to protect the wildlife in the area. Selective cutting is practised, which leaves the tree-crown layer of the forest intact. There are restrictions about cutting the fruit bearing tree bibosi (*Ficus* sp.), because of its importance for the fauna. The practice to use as many tree species as possible instead of picking a few, has the result that all pressure is not on a few species, although selective cutting could still change the species composition in the long run. The fact that the area is under forestry has a positive impact on biodiversity because the forest is relatively protected against being cut down for illegal selling, slash-and-burn or cattle rising. (R. Quevedo, pers. comm.)

4.1.3 Socio-economic Impacts

At Lago Rey there are no inhabitants, and there have been no disputes over land rights with indigenous tribes as it has been at La Chonta. One of the demands of FSC certification is that no land right disputes remain and that the forest company has good relations with inhabitants in and around the area of their concession. At La Chonta everything is quiet now. The indigenous population has legal rights to hunt if they want, but at present they don't enter the area of the concession. (R. Quevedo, pers. comm.)

There is not much use of non timber forest products in the area; only palm leaves for basketry are collected sometimes. (Personnel at the Tourist Information Bureau in Ascención de Guarayos, pers. comm.).

4.2 Impacts from the Sawmill

- Generation of wood residues; deposition, composting or burning of these residues
- Handling of wood ash
- Leaching of toxic resins and tannins from the bark to soil and water
- Handling of outflow water from dryers
- Demand of water for sprinkling and handling of used sprinkling water, tannins in used water
- Solid waste handling
- Smoke
- Noise
- Handling of oil and combustibles
- Drinking water quality and fish habitate water quality
- Laboural environment: ergonomy, cleaning, illumination, noise, protection clothes, hygiene
- Fire and accidents to personal

4.2.1 Impacts on Soil, Water and Air

The sawmill generates a lot of wood residues, which are burnt in a boiler that heats the wood dryers. About half of it is used, and the rest is deposited on the backyard of the sawmill. There are also plans to use the wood for generation of electricity in a vapour turbine. All the wood would thus be utilised. In the boilers only wood is burnt. The wood ash is buried in the area. The recommendation from Cimar is to burn wood residues, but at present the remaining residues from the sawmill are buried each day to decompose. It is not the wood but the bark that contains tannins and other organic chemicals. Some of the used wood species, especially ochoo, but also bibosi, paquio and coquino have toxic resins. The bark is deposited on the eastern side of the sawmill. In the dry season the residues are only in contact with the soil, but in the rainy season it can be flooded. There are no investigations about impacts on the water from chemicals leached from the residues. (G. Tabura & R. Quevedo, pers. comm.)

Below the residue deposit area some lagoons are constructed for infiltration of leach water. A branch of Rio Chico passes 5-10 m from the lagoons, with a bank in between. The outflow from the drying chambers is to be led to a separate pit, but the gutter is not completed and the outflow from the western side runs towards Rio Blanco. The outlet water from the dryers is thick and black-greenish, but it is said that tests have shown that it does not contain any harmful chemicals. Anyhow, no tests have been made at La Chonta. Used water from the boilers and drying chambers is led to an infiltration lagoon; it is about 100 l/day. Water from the dryers does not contain substances from the bark, only the wood, and is infiltrated in a special pit. (G. Tabura, pers. comm.)

Some experiments are carried out about sprinkling of wood. The wood in unsawn logs is stained in 2-7 days, and exposed to attack by fungi when the humidity is between 30 and 60%. In the test, the wood has been sprinkled for 40 days with good results. The water for the sprinkling is taken from Rio Chico, and used water runs to the infiltration lagoons, it doesn't go directly back into the river. The chemicals of the bark probably are leached out in concentrations too low to be dangerous, but there have been no tests (R. Quevedo, pers. comm.). The water from the irrigation runs in a small erosion rill down to the infiltration

lagoons. The greatest amount of used water entering the lagoons went from the irrigation, and this was only a small-scale test yet. (G. Tabura, pers. comm.)

Wastes from the lodgement are buried. Other types of wastes are left in a rubbish heap; sometimes a detail of a machine that not functions is sent to Santa Cruz to show what is needed in exchange. In the course of Rio Chico and in the watery lowland between the sawmill and the rivers, a lot of wood is thrown, and also some metal wastes such as old saw-blades. Some plastic, tins and other waste are also spread in the area, as well as around the lodgement.

4.2.2 Impacts on Flora, Fauna and Biodiversity

Of the species with toxic resin, ochoo is the most toxic and kills fish, and as a safety measure it is only sawn during the dry season. The fishes in Rio Blanco were alive, and there have been no observations of dead fish in the river. There have not been any systematical investigations though. Impacts to the surroundings of the sawmill do not seem big outside the direct working and dumping areas. Animals such as insects and birds are visiting the sawmill area as long as there are plants. The noise from the sawmill and generator reaches over the whole cleared area down to Rio Blanco/ Chico, but where there is forest the sound is soon subdued. (R. Quevedo, pers. comm.)

4.2.3 Health of Neighbours

The water from Rio Blanco is used as drinking water in the village Urubichá downstream the sawmill and the inhabitants are also fishing in the river. The lodgements at La Chonta have got a drilled well for drinking water. (G. Tabura, pers. comm.)

4.2.4 Handling of Chemicals and Combustibles

The wood is processed as fast as possible to avoid the use of chemicals such as insecticides and fungicides. As a mitigation measure no logging is carried out during rain, because this causes fungal attacks to the wood, and no logging is carried out during the black moon phase, because then the wood is said to crack (P. Antelo, pers. comm.). At present there is no use of biocides at the sawmill, and therefore no emissions of such chemicals to the water. (G. Tabura, pers. comm.)

Transports are done with diesel tractors and lorries. The roads in the forest are rather bad, so better roads would mean more even driving with less exhausts, and bigger loads means fewer tours. Drying the wood on site means half the weight to transport to the city, and the drying capacity at La Chonta will be increased to the double. There are routines for handing combustibles, but the persons in charge are not sure that the workers follow the routines while not supervised. There could therefore be spilling from diesel stock tanks and generator. Used oil from the lorries, about 15 l/month, is reused by 60% for the chains of the power saws, and the rest 40% is poured in a pit. (G. Tabura, pers. comm.)

4.2.5 Labour Environment and Industrial Security

An investigation has been made about labour environment and industrial security (Beijar, 1999). It contains some recommendations, and the implementation of these were discussed as a part of this study. The sawmills and the factory are under reorganisation, and thus some of the recommendations in the "Labour Safety" report are no more applicable.

The sawmill is situated under a roof but is open at the sides. It has got sawdust extraction, but still it is full of sawdust. People were cleaning the machines during the lunch break. The sawmill is in disorder and difficult to clean. The line will be improved, and it should be easier to clean the sawmill with the new order. (G. Tabura, pers. comm.)

The workers at the sawmill do not use ear taps. The workers don't want to use ear protection. The workers in the forest use protection helmets but not ear taps. The saw has recently got estellite points, that cut faster and with less noise. The electric generator is also noisy, but no measurements of the decibel levels of the sound at the lodgements have been done.

The problem with protection clothes is that the workers don't want to use them, and instead they sell personal equipment such as working shoes that is distributed to them, or quit the work after a week and take the clothes with them. The problem with theft depends on that Bolivia has got far too low salaries (the officer responsible of the timber stock for the sawmill at La Chonta, pers. comm.).

There is no local illumination at the machines in the sawmill, since this is not considered necessary. Local illumination is more needed at the carpentry with detail work at the machines. The sawmill has big working areas, and the general illumination is sufficient. Dirty lamps are a problem. In the new sawmill it will be an electrical centre separate from the working area, and in the old one the electrical system will be improved. People know how to handle the machines, but they don't do it right, for sometimes it is easier to do it in a wrong way. People also know that they should not clean their hands with gasoline instead of soap, but do it anyway because it is faster, and they don't care that smoking is prohibited to avoid fires. Ergonomical equipment does not exist in Bolivia, since it is too expensive to import it. (G. Tabura, pers. comm.)

There is no formal preparation for accidents, and not many accidents occur in the forest. In the sawmill the main risk is accidents to the workers. The administrators are trained in first aid, but if more serious accidents or illnesses occur, the person is brought to the hospital in Guarayos. Fires too are a considerable risk, and the engineering plant was burnt down the past year. There is a fire engine in the sawmill; it is only a water tank that functions with elevation pressure. Almost every day they control that it is water in the tank. Accidents arise mainly from the human factor, since the people have too much confidence in their own capacity, or in their luck. (G. Tabura, pers. comm.)

4.3 Impacts from the Carpentry

- Noise
- Smoke
- Wood ash
- Solid waste handling
- Use of chemicals: biocides, solvents
- Handling of oil and combustibles
- Laboural environment: ergonomy, sawdust, cleaning, noise, protection clothes, hygiene
- Accidents to personal, fire

4.3.1 Impacts on Soil, Water and Air

The environment near the carpentry is not sensitive, since it is an industrial area, and neither does the carpentry generate a lot of pollution. There is some smoke from wood burning. No wood residues are remaining from the carpentry; wood is burnt for energy, and sawdust is collected in a silo and sold to make bricks. There are ideas of burning sawdust, too, in the boiler, but then the direction of the whole system of extraction has to be reversed. The wood ash is deposited on the road in the industrial area to stabilise the sand as a way to improve the road. Solid residues like paint tins probably are buried in a pit and there is no control. (R. Patzi, pers. comm.)

4.3.2 Health of Neighbours

The carpentry is situated in an industrial zone, but urbanisation is taking place nearby, and thus there could later be impacts to the new neighbours. The housings are still far away, but the urbanisation keeps growing. It is difficult to take any measures against the noise. The noise isn't probably any problem for the existing neighbours, the machines are not that noisy and they are situated in a building, and still there is much space in the surroundings of the carpentry. The smoke could be a problem. It is possible to buy filters but at present it is probably too expensive. (Marco, pers. comm.)

4.3.3 Handling of Chemicals and Combustibles

In the timber yard, Osmose L20, Osmocobre, and DirethAM-Ars We48 are used. The utilisation is about 200 l/year, mostly insecticides in the timber stock. Insecticides used are biodegradable according to the company in Chile that sells them. One single worker is handling the chemicals, he is trained in personal safety and wears protection clothes. For exportation, the containers are smoked with phostoxin or gastoxin, which contains aluminium phosphate, because Chile demands this smoking for the transit through the port of Arica. (P. Antelo, pers. comm.)

Tins containing laquer and barnish have little information on them about the content of chemicals. Most of them only declare that the product is inflammable. It could be solvents like toluene, alcohol, petrol etc. There are no products without such solvents on the Bolivian market. The paintery has got ventilation to improve the environment for the workers, but the

solvents are thus contaminating the air. The tints come from the USA and no one knows if the pigments contain cadmium. The painted doors are about 2% of the production. Glue for wood comes from Akzo Nobel/ Casco. (R. Patzi, pers. comm.)

Combustibles are stored in a stock in an amount that is needed in a month. There are routines for handling the combustibles. (G. Tabura, pers. comm.)

4.3.4 Labour Environment and Industrial Security

The principal problem in the carpentry building is that the air is contaminated with sawdust. A system for extraction is constructed, with silos for the sawdust. Extraction of sawdust functions in one working line, but is not completed in the other line. In the rest of the factory there are still no designs of a system for aspiration. The factory had employees for the cleaning before, but not now because of the economic crisis in the whole of Bolivia. The carpentry workers have to clean, but their fore-men demand that they work with the production until the last minute of the turn. In total, more work is now done with fewer employees than two years ago. (R. Patzi, pers. comm.)

A nurse was to come once a week to make a study in labour ergonomy and protection such as masks for dust etc., but she only came once. The recommendations that she made has been implemented. Some of the workers wear ear protection and dust masks. It is difficult to reduce the noise further. People do not want to use ear taps. There are training courses given by the enterprises that sell equipment for protection. The enterprise can not afford working clothes and shoes, but next year a working uniform will be introduced, which will be partly paid by the enterprise, partly by the workers themselves. (R. Patzi, pers. comm.)

Containers for residues have been built, the floor has been improved, and the factory now has loading stools with wheels. Transporters for the working pieces won't function unless the machines are rearranged, but transporters for the waste pieces are planned. The workers have blocks for sandpapering work, but it is not possible to reach everywhere with these. The illumination is placed lower at detail working places. New showers and toilets are under construction. It is difficult to provide soap, because the people steal it. (R. Patzi, pers. comm.)

There is no formal preparation for accidents. An analysis of risks has not done, but it is more or less known what could happen. In the carpentry, fire is the main risk. Not many accidents occur, and not that serious that they could be in the sawmill. There is training for everyone how to avoid accidents. There is documentation of accidents; the staff manager has this register. Incidents are not documented. There are no routines of using information about accidents, but of course the administration tries to improve the safety. (R. Patzi, pers. comm.)

G. Tabura is the supervisor of fire protection. Everyone is responsible for that the equipment functions and that the staff uses protection. There is an alarm, and a water tank with hydrant points. The system for extinguishing fires is over-dimensioned. The enterprise gives courses how to prevent fires. There is not much documentation about fire incidents. The fire risk is bigger with dry wood, inflammable species and strong wind. Sparks entering the silo for sawdust has been a problem. There are rules how to avoid fire, for instance someone who is working with soldering has to keep equipment to extinguish fires at his side. There is rescue staff, but the others don’t know what to do in case of accidents; they are just running around in confusion. (G. Tabura, pers. comm.)

5. Discussion

5.1 Environmental Considerations

There are a lot of incentives for the work with environmental aspects. To improve the labour safety and avoid accidents in the industry would also mean to improve the production, because this avoids costs for training another person to replace the one that had an accident (G. Tabura, pers. comm.). To control waste handling and emissions is to take responsibility for the health of the neighbours of the industrial plants (Marco, pers. comm.). Ecological considerations will benefit the company in the long run by diversification of the production. The market buys certified wood of a variety of species, not only mahogany which is in the risk of running out of stock due to overexploitation (R. Quevedo, pers. comm.). A progressive environmental practice will help the company to avoid getting into problems with the authorities, not now but in the future, when the authorities and laws hopefully begin to function (Marco, pers. comm.).

Environmental impacts from the forestry is also connected to the productivity of the company and the quality of products. Increasing the yield of the sawmill and improving the quality will decrease the impact on the forest, thus less trees will be needed to be cut for the same amount of final products. At present, 35-45% of the wood becomes boards, but the yield from the sawmill could be up to 60-70%. And of the boards, 40% become final products. The yield could be increased by adapted cutting in the forest. It could also increase by a faster entry to the dryers or by irrigation of the wood, to avoid fungal attacks at the end of the logs, where now a considerable margin is needed to secure the desired length of the boards. Also an improved drying process with automatic supervision to reduce warping and cracks will make it possible to saw thinner boards and reduce the waste, and automatisized sawing reduces the risk that someone makes a mistake. Finally, a better yield in the carpentry could also be obtained, with generally better wood quality of the boards, and by alternative use for wood of second-rate quality. (P. Antelo & R. Quevedo, pers. comm.)

5.2 Capacitating

Capacitating is the way of reaching one's goals. The present capacitating is directed towards the administration of the carpentry. It is they who design new routines; they are the first ones that have to learn how new equipment functions. There are courses for the administrators, *e.g.* one that will be given by UPSA about production and technology. The consultancy evaluations also give opportunities for capacitating of the administrators. Training is also given to those responsible for the forest operations, harvesting activities and to the operators of machines. There is no formal capacitating for the rest of the employees. New workers are assistants for 1-2 months, when they learn how to manage machines by looking at the operator. Rotation of staff is a problem, but this is now decreasing and it is less than the rotation of staff at other similar enterprises. The administration is almost permanent, in the carpentry there is about 10% rotation per year, and the sawmill only has seasonally employed workers.

5.3 Conclusions and Recommendations

5.3.1 Forest

The forestry appears to be well managed and supervised with regard to the environment, as is the intention of promoting La Chonta as a model company and good example. The forestry activities are already certified in accordance to FSC criteria and supervised yearly by Cimar. Felling practices seems to be very good, and a certain impact on surrounding trees, flora and fauna is inevitable, as well as erosion from transporting of logs.

The most considerable impact is long term changes of the species composition. It should be of interest to investigate the impact on biodiversity over time, as in the research started by L. Quevedo. Investigations about enrichment could also be valuable.

The indigenous population has hunting rights in the concession area, but they don't enter the area. A question of interest is if they have the actual possibility to make use of their formal right, or why they don't utilize it.

5.3.2 Sawmill

Wood residues, sawdust and bark could either bee composted or burnt. Both treatments result in liberation of CO_2 into the air. If the wood residues are to be burnt, this should be done in a stove, not in the open, because the latter will result in uncompleted combustion that is environmentally harmful. Wood residues burnt for energy are environmentally preferable before other, fossil, energy sources. An investment in a vapour turbine would then not only reduce the need of combustibles, but also the need of areas for dumping residues, a double environmental gain.

Wood ash is not only a residue, but also a resource as a fertilizer. The dry ash consists of oxides with a high pH that will "burn" the ground if directly applied. Less than 3 tons of ash/ha will cause no damage. If treated with water, the oxides turn to hydroxides, which stabilize into carbonates in contact with air. New techniques for production of fertilizer has been developed: by compaction of wet ash, granulate of good quality is cheaply produced. Ash recycling to forest production areas are more useful where the loss of nutrients is high, while not only trunks but also branches are harvested. To bee suitable as fertilizer, the ash has to consist of only wood residues. (L. Lövgren, pers. comm.)

Used oil poured into a pit will harm the ground water. It is environmentally less harmful to burn the oil. Some of the oil is used on power saw chains, and thus spread in the forest. In the long run it would be better to search for less harmful lubricants. Besides, the handling of combustibles seems to be under insufficient control; one of the responsible officers said that you never know how well the workers follow the directions in practice.

The irrigation of logs could be more precise by the investment in a system for measuring the humidity, and the water need reduced by recycling the water. The infiltration lagoons could bee cleaned, like at the sawmill in Kopparfors, Sweden, where infiltration ponds are cleaned three times a year and sediments are moved to deposit areas (A. Bengtsson, pers. comm.). A possible investigation could be what happens with the lagoons during the inundation period, if

there is leaching of tannins from wood residues during the wet season and if the fish are affected by ochoo.

To reduce noise from the electric generator, it would be possible to build a noise reduction wall, which has to be thick and tight. The best way to reduce noise is to bury the noise source. With the generator located in a pit, the noise will only spread straight upwards. Another solution is to enclose it in a house. (C. Larsson, pers. comm.)

5.3.3 Carpentry

The environmental effects from the carpentry are mainly affecting labour environment, which could be improved by education. Training could be carried out in subjects like safety for workers, preparation for accidents, safety in case of fire, use of clothes for protection etc. The administration could improve the documentation of accidents and incidents, and make an analysis of risks.

Among the impacts on the surroundings, emission of solvents from the paintry is included. At the moment, a closed system for the paintry, which is a small part of the production, is a very expensive investment for the company. Another impact is smoke emission from the stoves, which could be reduced with a smoke filter, also an expensive investment. It could also be possible to improve the combustion, a more complete combustion leaves less emissions. A long term environmental goal might be to find ways of reducing the impacts mentioned above.

5.3.4 Organisation

As for organisation, my suggestion is that La Chonta formulates an Environmental Management System in accordance to the system in ISO 14 000, without certification as primary goal but only to develop the system. The company could create an environmental policy and establish environmental goals for the whole range of activities within the company, and recurrent environmental revisions would show whether the goals yet were reached or not. The policy should consider the questions of what is the environment worth, what will be done and by whom, and to which cost, and the revisions will give the answers about what has actually been done, and how it does work. An environmental management system will make it possible to consider environmental improvements on both short and long term, and include big and expensive investments as well as mitigation measures against smaller and less considerable environmental impacts.

6. Acknowledgements

I am deeply grateful and would like to express my thanks to all the persons and institutions that made it possible for me to execute this study. Perhaps I should start with thanking my grandmother for getting me interested in environmental issues at the very beginning, and my parents for encouraging me to realize my dreams. For the choice of issue for my study, I want to thank Sida in Stockholm, where I earlier made an EIA study on forestry in India, and first came in contact with SCC Natura, and also the personal at SCC Natura in Sweden who searced for and finally suggested a possible issue for the study I wanted to do in Latin America. I also must thank Sida, Ingvar Backéus and Arbetsgruppen För Tropisk Ekologi (ATE) at the Centre of Evolution Biology, Uppsala University, that assigned me a MFS scolarship for the study. Then I must thank my supervisor for the thesis, professor Lennart Strömqvist, for help, advice and confidence in me and my idea, and Lars-Gunnar Marklund, my in-field supervisor, for practical help of all kind, providing of information, and arrangement of meetings. The other swedish advicers, Toby, Nils and Per, I also want to thank for taking care of me and telling me about Bolivia, forestry and their work at Promabosque. But most of all I direct my gratitude towards the Bolivian people, for their kindness, considerateness and patience with the “gringa” trying to understand their socieity, politics, forestry - and language! I specially want to thank Pablo Antelo, the general director of La Chonta, for all the time he spent with me and my questions, and of course the other administrators of the company, Roberto Quevedo, German Tabura and Roberto Patzi. I also owe thanks to several other persons, for setting aside time for me and explaining all the things I needed to know, noone mentioned and noone forgotten. Finally, I want to thank Sofia at Promabosque for bringing me warm chocolate every now and then and making my working time enjoyable...

7. References

Laws, regulations and technical standards:

Ley general de Higiene, Seguridad Ocupacional y Bienestar, Bolivia 1978.

Ley de Medio Ambiente, No 1333, Cochabamba, Bolivia 1992.

Reglamento a la Ley de Medio Ambiente, D.S No 24176, Cochabamba, Bolivia, 1992.

Nueva Ley Forestal, No 1700. Published by Bolfor. Santa Cruz, Bolivia, 1997.

Reglamiento de la Nueva Ley Forestal, D.S No 24453. Published by Bolfor. Santa Cruz, Bolivia, 1997.

Estandares para la Certificación del Manejo Forestal. Published by CFV. Santa Cruz, Bolivia, 1998.

Books:

Almgren, R. 1990: Miljörevision. Industriförbundets förlag AB, Stockholm, Sweden.

Canter, L. W. 1996: Environmental Impact Assessment. McGraw-Hill Inc., USA.

Marcus, H. O. 1998: Företagets miljöarbete i praktiken. Miljö i ett företagsperspektiv (antology). Sweden.

Network papers, Rural Development Forestry Network, London, UK:

Colfer, Prabhnu & Shepherd, 1998. RDFN paper 23 a) Criteria and indicators for Sustainable Forest Management.

Bass, S. 1998. RDFN paper 23b) Forest Certification - The Debate about Standards.

Alfaro & de Camino, 1998. RDFN paper 23c) Certification in Latin America: Experience To Date.

Sida publications, Sweden:

Sida, 1997: Det skogliga biståndet

Sida 1998: Riktlinjer för miljökonsekvensbedömningar i utvecklingssamarbetet

Sida 1999: Hållbart skogsbruk

University Theses and Studies:

Darby, J. 1998: Of markets and forests: Certification and sustainable forestry in Bolivia. Thomas J. Watson Foundation, USA.

Davies, P, 1999: An analysis of the objections to and views on the Forestry Law of Bolivia. Institute of Governement Science, Uppsala University, Sweden.

Castro & Veliz, 1999: "Diseño de una política general para introducir la gestión ambiental en la industria azucarera del departamiento de Santa Cruz a través de un modelo", Universidad Católica Boliviana, Santa Cruz, Bolivia.

Unpublished written material:

Beijar, L. 1999: "Diagnóstico de ambiente laboral y seguridad industrial de la empresa La Chonta Ltda", investigation report by SCC Natura.

Quevedo, R. 1998: Plan de manejo (Concessión La Chonta y Lago Rey).

Quevedo, R. 2000: Plan operativo (Concessión La Chonta y Lago Rey).

Sida & Cámara forestal de Bolivia, 1997: The Forestry & Industry Development Programme.

Sjödin, T. 2000: Bolivia - En viktig leverantör av certifierat tropiskt virke.

Internet sources

FSC 2000, http://www.fscoax.org

The ISO organisation 2000, http://www.iso.ch

La Chonta, 2000: http://www.lachonta.com

SmartWood 2000: "Resumen público de certificación de Empresa Agroindustrial La Chonta Ltda", http://www.smartwood.org/reports/la-chonta.html, 2000-08-15

Interviews:

Ampuero, Ruddy. the Sida office at La Paz. Personal interview in La Paz, 20 Nov. 2000.

Antelo, Pablo. General director of La Chonta. Personal interviews in Santa Cruz, between 1 Sept. and 15 Nov. 2000.

Avila, Jorge. Lawyer, Cámara Forestal de Bolivia. Personal interview in Santa Cruz, 24 Oct. 2000.

Bengtsson, Annika. EMS responsible at the Stora Enso sawmill in Kopparfors, Sweden. Telephone interview, May 2001.

Camacho, Roberto. Unidad Forestal, Prefectoria del Departemiento. Personal interview in Santa Cruz, 8 Nov. 2000.

Hermind, Benét. Adviser at Programa de Cooperación Danesa al Sector Medio Ambiente. Personal interview in Santa Cruz, 8 Nov. 2000.

Häger, Nils. SCC Natura, assisting adviser, Promabosque. Personal interviews in Santa Cruz, between 28 Aug. and 17 Nov. 2000.

Larsson, Conny. Noise expert, Institution of Meteorology, Uppsala University, Sweden. Telephone interview, May 2001.

Lövgren, Linnea. Stora Enso Research, Sweden. Telephone interview, May 2001.

Marklund, Lars Gunnar. SCC Natura, chief technical adviser, Promabosque. Personal interviews in Santa Cruz, between 28 Aug. and 17 Nov. 2000.

Matkovic, Damir. Director of Promabosque. Personal interview in Santa Cruz, 31 Aug. 2000.

Nilsson, Annika. Adviser at PAIB, a project about environmental inspectors in Bolivia. Personal interview in Santa Cruz, 1 Sept. 2000.

Patzi, Roberto. Responsible of carpentry at La Chonta. Personal interview in Santa Cruz, 25 Oct. 2000.

Quevedo, Lincoln. Ecologist, University of Florida. Personal interview in Santa Cruz, 19 Oct. 2000.

Quevedo, Roberto. Responsible of forest activities at La Chonta. Personal interview in Santa Cruz, 30 Oct. 2000.

Sjödin, Torbjörn. SCC Natura, marketing adviser, Promabosque. Personal interviews in Santa Cruz, between 28 Aug. and 17 Nov. 2000.

Soto, Rafael. Commissión Medio Ambiente, Prefectoria del Departemiento. Personal interview in Santa Cruz, 8 Nov. 2000.

Tabura, German. Responsible of energy and drying chambers at La Chonta. Personal interview in Santa Cruz, 3 Nov. 2000.

Thomsgård, Per. SCC Natura, engineering adviser, Promabosque. Personal interviews in Santa Cruz, between 28 Aug. and 17 Nov. 2000.

Vranjican, Ivo. CAINCO, Cámara de Industria. Personal interview in Santa Cruz, 30 Oct. 2000.

Subadministrator of the carpentry, La Chonta. Personal interview in Santa Cruz, 25 Oct. 2000.

Responable officer of the timber stock at the sawmill at La Chonta. Personal interview in La Chonta, 7 Nov. 2000.

Personnel at the Tourist Information Bureau in Ascención de Guarayos. Personal interview in Acención de Guarayos, 7 Nov. 2000.

Annex 1: Acronyms and Abbreviations

ASDI/ SIDA - Agencia Sueca de Desarollo Internacionál,
Swedish International Development Agency
BOLFOR - Proyecto de Manejo Forestal Sostenible, Sustainable Forestry Project
CFB - Cámara Forestal de Bolivia, the Forestry Chamber of Bolivia
CIMAR - Centro de Investigación y Manejo de Recursos Naturales Renovables,
Centre of Investigation and Management of Renewable Natural Resources
CFV - Consejo Boliviano para la Certificacion Forestal Voluntaria,
Bolivian Council of Voluntary Forest Certification
Concession, forest area where cutting rights are issued by the Bolivian State
COSECHA - "Harvest", an forest growth and harvesting model of Bolfor
EIA - Evaluación de Impactos Ambientales, Environmental Impact Assessment
EMS/ GA - Environmental Management System, Sistéma de Gestión Ambiental
FA - Ficha Ambiental, Environmental Registration
FNMA – Fondo Nacionál para el Medio Ambiente,
the National Fund for the Environment and Renewable Resources
FSC - Forest Stewardship Council
IBNORCA - Bolivian Standardisation Organisation, member of ISO
ISO - International Standardisation Organisation
ISO 9 000 - standards on quality management systems
ISO 14 000 - standards on environmental management systems
LA - Licencia Ambiental, Environmental Licence
MDSMA - Ministerio de Desarollo Sostenible y Medio Ambiente,
the Ministry of Sustainable Development and Environment
NGO - non governemental organisation
PD - Prefectura de Departamiento, Prefectory of Department
PROMABOSQUE - Programa de Manejo de Bosques y Reforestación,
Program of Forest Management and Reforestation
SCC Natura - Scandiaconsult Natura
SF - Superintendencia Forestal, Forestry Supervision Agency
SMARR - Subsecretaria del Medio Ambiente y Recursos Renovables,
Subsecretary of Environment and Renewable Resources
SMARTWOOD - USA based forest certifier
SNRNMA – Secretaría Nacionál de Recursos Naturales y Medio Ambiente,
National Secretary of Natural Resourses and Environment
UPSA - University in Santa Cruz
USAID - USA's aid program

Annex 2: List of tree species mentioned in the study

bibosi (*Ficus* sp.)
cambará (*Erisma uncinatum*)
cedro, cedar (*Cedrela odorata*)
coquino
mara, mahogany(*Swietenia macrophylla*)
ocorocillo
ochoó (*Hura crepitans*)
paquió (*Hymenaea courbaril*)
roble (*Amburana cearensis*)
sauco (*Zanthoxylum* sp.)
serebó (*Schizolobium amazonicum*)
verdolago (*Terminalia oblonga*)
yesquero (*Cariniana estrellensis*)

A log of a darkwood species (perhaps paquió) has just been cut. The surrounding vegetation is left untouched. Only about 3 trees/ hectare are felled.
Photo: Ylva Svensson

Annex 3:

Audiatoria ambiental de la empresa forestal La Chonta Ltd:a

Resumen ejecutivo en Español

Índice:

1. Motivos del estudio
2. Introducción
    - 2.1 Certificación
    - 2.2 Situación forestal de Bolivia
    - 2.3 Marco legal
3. La Chonta
    - 3.1 Descripción general
    - 3.2 Manejo forestal
    - 3.3 Investigaciónes
    - 3.4 El aserradero en La Chonta
    - 3.5 La carpinteria en Santa Cruz
    - 3.6 Legislación
4. Resultados
    - 4.1 Impactos del manejo forestal
    - 4.2 Impactos del aserradero
    - 4.3 Impactos de la carpinteria
5. Discusión
    - 5.1 Consideraciónes ambientales
    - 5.2 Capacitación
    - 5.3 Concluciónes y recommendaciónes

1. Motivos del Estudio

Sostenibilidad ambiental es un tópico de ascendiente interés global. Para un país en su incipiente proceso de industrialización, como es Bolivia, es de importancia que su desarollo económico sea coherente con un criterio crítico de sostenibilidad ambiental. La Agencia Sueca de desarollo internacionál, ASDI, financia una Programa de desarollo forestal, en el cual la EIA, Evaluación de impacto ambiental, es una parte integrál de éste proceso.

El presente estudio es ejecutado entre 28 Aug. y 20 Nov. de 2000, en una de las empresas forestales que reciben assistancia técnica del Programa. El estudio trata principalmente el impacto ambiental del aserradero y carpenteria, y no de los impactos a consecuencias de las actividades forestales, ya que estos están certificados con relación a los criterios de FSC, y tampoco del marco legal, porque la certificación de FSC demanda conformidad con los leyes.

2. Introducción

2.1 Certificación Forestal

Certificación Forestal es un processo formal y volontario. Un inspectór externo extiende un certificado de la calidad del manejo forestal conforme a las normas específicas. Hay dos tipos de normas; normas de performancia (como FSC) que tratan de operaciones y sus impactos, y normas de procesos (como ISO 14 000) que tratan de políticas y sistemas de manejo.

La Organisación Internacionál de Estandarización, ISO, ha producido normas tecnicas desde 1947. Más reciente, ISO también ha empezado a producir normas para procesos de produción, a saber ISO 9 000 de sistemas de manejo de calidad, e ISO 14 000 de sistemas de gestión ambiental. La idea de mejoramiento continuo es de caracter central; la compañia pone metas para lograrlos, sacar enseñanza, y luego estructura nuevas de las ya abtenidas, es decir metas aún más ambiciósas. Con respecto a la práctica forestal, el ISO refiere a especificaciónes de manejo elaborados por FSC y otras organisaciónes forestales.

Forest Stewardship Council, FSC, es una organisación internacionál, formada para ejecuter certificación forestal y para tratar problemas actuales de manejo forestal, especialmente problemas ambientales. La actividad principal de FSC es acreditar y supervisar a los certificadores que evaluan empresas forestales. FSC ha elaborado un documento con 10 Principios y Criterios globales para buena administración forestal. Tambien tiene una Programa Internacionál de acreditación para certificadores, y una marca registrada para productos de bosques certificados. Además, FSC da asistencia en el desarollo de normas locales que especifican demandas de certificación a nivel regional y nacional.

2.2 Situación forestal de Bolivia

Bolivia tiene gran recursos forestales; casi la mitad del país es cubierto con bosque. 12% del área, 6 million hectares, tiene planos de manejo forestal, y 11% de estos tienen un certificación ambiental. La producción podria aumentar 5 veces al respecto de volumen, y 10 veces al respecto de valór, sin affectar la sostenebilidad. La desventaga principial del sector forestal son altos costos de producción, causados por distancias grandes, infrastructuro malo y

technologias inefficientes. La Programa de Desarollo Forestal assiste a un grupo de "compañias modelos", para desarollar manejo forestal sostenible inclusive corta con impacto bajo y certificación forestal, mejoramiento del equipo industrial, publicidad de mercado y venda de los productos maderables. El impacto directo de la corta selectivo tradicionál es bajo, pero los arboles valuables son sacados, y un red de caminos es dejado, donde vienen pesantes y rancheros que corta y quema. Para recibir un manejo forestal sostenible, se debe cortar no más que crece el bosque, y guardar que no se cambia la composición biological o el estructuro fisical de la bosque. Sin embargo, los efectos ecologicos en largo plazo, aún en un manejo forestal sostenible, son casi desconocidos en bosques tropicales.

Bolivia es el primer país no-Europeo que ha elaborado criterios nacionales de certificación en acordancia con las criterios de FSC, y es uno de pocos países tropicales que tiene un certificadór nacionál, Centro de Investigación y Manejo de Recursos Naturales Renovables, Cimar. Un factor importante para promover la certificación en Bolivia fue la nueva ley forestal de 1996, que estipula la utilizacíon sostenible de los recursos forestales, y exige a todas las empresas forestales un plan de manejo con estrategias específicas para preservar la sostenibilidad de la produción. Las normas nacionales para la certificación conforme con la ley; certificación entonces es un paso pequeño para las compañias obeiendo a la ley. Además, las compañias entienden la certificación como una estrategia importante para tener publicidad de mercado para sus productos. El Consejo Boliviano para la Certificación Forestal Voluntaria, CFV, ha elaborado las normas nacionáles. Este trabajo era un proceso importante para ganar apoyo para la idea de certificación de compañias forestales, comunidades locales y intercesores de medio ambiente, y para recibir entre ellos consenso de que es la mejor utilización de los recursos forestales de Bolivia.

2.3 Marco legal

La ley de Medio Ambiente de 1992 es la unica ley aplicable en la administración del medio ambiente. La ley demanda una Ficha Ambiental, que avala si la compañia necesita una Evaluación de Impacto Ambiental, EIA. La ley de medio ambiente es supervisado por MDSMA, pero por falta de recursos, la ley es poco aplicado en el pais. La ley forestal de 1996 es supervisado por La Superintendencia Forestal, SF, y es casi totalmente aplicado.

3. La Chonta

3.1 Descripción General de la empresa forestal La Chonta Ltd:a

La Chonta es una de las “compañias modelos” que reciben asistancia técnica del programa de desarollo forestal. La empresa corta y procesa los productos maderables. Tiene una carpinteria en Santa Cruz, y dos concesiónes con aserraderos. La Concesión La Chonta esta a 300 km de Santa Cruz, y Lago Rey a 600 km. Lago Rey ha sido aprovechado por 17 años, La Chonta por más de 25 años. Existe una pueblación indigena cerca de la concesión La Chonta. No hay pueblación en Lago Rey. La carpinteria produce puertas y pisos para exportación. Todas las actividades son certificados por FSC, y la empresa intenta tambien obtener certificación de ISO en el futuro.

3.2 Manejo Forestal

La concesión La Chonta es de 100 000 hectareas, del cual 13% es bosque denso, 50% bosque intermedio, y 36% bosque ralo que fue quemado en 1995, y ahora es area de protección y area de regeneración. El ganadero es una amenaza para el bosque porque queman y crean incendios. Un programa para controllar incendios está en elaboración. En los alrededores de La Chonta hay areas quemadas, 13 milliones de hectareas fuerón quemadas en 1999. La Chonta tiene bosque humedo subtropical. De las especies maderables, hay 2% muy valuable (mara), 4% valuable, 39% con valor bajo, y 55% sin valor commercial. Las especies aprovechadas son ochoó, bibosi, yesquero, ocorocillo, serebó y verdolago. La Concesión Lago Rey es de 120 000 hectares, de qual 77% es bosque productivo. Las especies aprovechadas son cambará, bibosi, sauco y paquió. Lago Rey tiene bosque humedo de tierras bajas.

El administrador forestal, R. Quevedo, ha escrito un Plan de Manejo por cada concesión, y escribe un Plan Operativo a principio de cada año. El PO contiene volumen de censo, marca de árboles aprovechables y árboles semilleros, instrucciónes técnicas para corta de impacto bajo, como la tala dirigida y arrastre de los troncos para minimizar la necesidad de caminos. Tambien el PO incluye mejoramiento del aserradero. En el área de protección y de regeneración, se hará investigaciónes sobre la reforestación; plantaciónes y enriquecimiento quizás con la especie mara.

Las concesiónes son situadas en áreas con bosque natural. La ambición de la empresa es afectar al ecosistema lo menos posible. Aplican la corta de impacto bajo. Especies sin valor comercial no tocan. Talan aproximadamente 3 árboles/ hectarea, arrastran los troncos hasta los caminos y luego son transportados en camiónes para el aserradero. Aplican la tala dirigida, y tratan de no dañar los árboles jóvenes. Antes de la tala, cortan las lianas para facilitar la tala dirigida. Cursos de agua tiene una zona de protección de 10 m, donde no se tala árboles. Un ciclo de aprovecho es estimado a 30 años. El área es divido en 30 partes de igual tamaño, y una de estas es aprovechada cada año. Simpre dejan 20% de los árboles maduros como árboles semilleros. La ley forestal permite corta de árboles con un diametro al pecho más que 50 cm por especies pequeñas como yesquero blanco y ocorocillo, ó 70 cm por especies grandes como ochoo y bibosi. La Chonta exige diametros de tala 60 respectivamente 80 cm. Àrboles más grandes tienen más alta densidad en la madera y por eso mejor calidad. Ramas con diametro más que 30 cm y 2 metros de largo tambien son aprovechadas.

3.3 Investigaciónes

Se sabe muy poco del ecosistema tropical. La tala de árboles puede cambiar la composición de especies. Las medidas de mitigación consisten por ejemplo de conservar los árboles semilleros y tratar de cuidar los árboles pequeños de especies preferibles cuando realizan la tala. La ecologista L. Quevedo esta haciendo investigaciónes del ecosistema sobre aprovechamiento, y va a establecer tres sitos de investigación, un de estos en La Chonta. La investigación trata sobre la reacción forestal en varias operaciónes silviculturales, como cortar lianas, entresacar, aprovechar, y quizás plantar mara donde se tala bibosi. Antes sólo se talaban mara, roble, cedro y un poco de paquió. La calidad del bosque es el mismo fuera de la reducción de estas especies, por eso La Chonta decidió de un moratorio de corta de ellos. Paquio no esta tan reducido, y continuan con la tala de este. Enriquecimiento con mara podria aumentar el valor del bosque, y es legal, mientras la plantación de reemplazo de bosque natural no es legal.

3.4 El Aserradero en La Chonta

El aserradero en concesión La Chonta es situado entre Rio Blanco y su afluente, Rio Chico. Ambos lados de la peninsula son inundizados. La epoca seca dura por 8 meses/ año, pero durante 2 meses se puede ocurrir inundaciónes. La planta en La Chonta ocupe más o menos 20 administradores y 50 -70 obreros. Lago Rey tiena la misma capacidad, pero en la reorganisación en año 2001 sera cerrado, mientras la capacidad en La Chonta sera doblado. El aserradero recibe su electricidad de un generador de diesel, que sera cambiado por una turbina a vapor. Los impactos mayores del aserradero son los residuos de madera y el ruido. El generador esta en marcha durante las 24 horas, tambien en las noches quando no trabajan en el aserradero.

3.5 La Carpinteria en Santa Cruz

La mayor parte de la producción de la carpinteria consiste de puertas. 2% de estos son pintados o laqueados y vendidos en el mercado local, mientras el resto son exportados a los Estados Unidos, sin tratamiento. La carpinteria esta situada en un edificio con paredes, en una zona industrial en Santa Cruz. La carpinteria tambien tiene secadores, que son calentados con residuos de madera. El aserrin es recogido en un silo y vendido.

3.6 Legislación

La ley forestal de 1996 demanda un Plan de Manejo que incluye consideraciónes ambientales, y la certificación demanda supervisión por Cimar con todas las leyes relevantes en las actividades de la empresa, principalmente la ley forestal, la ley de medio ambiente, y la ley laboral. La Chonta ha aplicado una Licencia Ambiental, pero después nada más ha ocurrido. Las autoridades controlan la seguridad industrial una vez por año, pero en los aspectos del medio ambiente no hay control.

4. Resultados

4.1 Impactos del Manejo Forestal

- Erosión a lo largo de las pistas de arrastre y en los caminos
- Daño de árboles en en radio donde se realiza la tala
- Alteración del habitad de la flora y fauna
- Alteración de composición de las especies maderables
- Impactos socioeconomicos en los inhabitantes del área

Impactos al Suelo, Agua y Aire

El impacto mayor es la cosecha. Caminos que erosionan el suelo, y con ello algunos problemas minores relacionados con la erosión. Medidas de mitigación podria ser construir caminos con mejor técnicas. Rio Blanco no es muy sensible a la erosión, y la cosecha es prohibido cerca de los rios. Otro impacto es durante la tala, que el árbol puede caer en otra dirección a la planificada y dañar otros árboles.

Impactos a la Flora, Fauna y Biodiversidad

Hay medidas para mitigar impactos a la biodiversidad. La caza es prohibida para los empleados de la empresa, es una medida de protección a la fauna en el área. Hay restricciónes a la tala del bibosi, por la importancia de su fruta a la fauna. La utilización de diversas especies reduce la presión en los especies más valuables, pero todavia la composición de especies se puede alterar a mediato plazo. Las actividades forestales tienen un impacto de beneficio a la biodiversidad, porque el bosque esta bastante protegida de la corta ilegal ó de la quema por los colonizadores.

Impactos Socioeconomicos

En Lago Rey no hay habitantes indigenas. En La Chonta había una disputa con los indigenas sobre derechos a la poseción de tierra, pero ahora todo esta tranquilo. Los indigenas tienen derecho legal a la caza, pero actualmente no entran al área de la concesión. No utilzán muchos productos forestales no maderables en la región.

4.2 Impactos del Aserradero

- Generación de residuos de madera; deposición, compostación o quema de estos residuos
- Manejo de la ceniza
- Desalación de resinas tóxicas y tanninos de la corteza al suelo y agua
- Manejo del agua usada en las camaras del secado
- Demanda de agua para riego, manejo de agua usada, y tanninos en el agua usada
- Manejo de basura
- Humo
- Ruido
- Manejo de aceite y combustibles
- Cualidad del agua potable, y calidad del rio como habitad para los peces.
- Ambiente laboral: ergonomia, limpieza, iluminación, ruido, ropa de protección, higiene
- Incendios y accidentes del personal

Impactos al Suelo, Agua y Aire

El aserradero genera muchos residuos de madera, la mitad de éste se utiliza para quemar en las secadoras, el resto se deposita. Hay planos para cambiar el generador de diesel para una turbina de vapor, toda la madera seria entonces quemada como energia. En las calderas solamente queman madera. Entierran la ceniza en el área. Cimar recommienda quemar los residuos de madera, pero ahora lo entierran todos los dias para su decomposición. Es la corteza, no la madera, que tiene tanninos y otros quimicos orgánicos. Ochoo, bibosi, paquio, coquino tienen resina tóxica. Tanninos hay en la corteza, lo botan como residuo al lado de la fabrica. En la época seca los residuos solamente estan en contacto con el suelo, pero durante la época de lluvias se puede inundar. No hay investigaciónes sobre el impacto al agua de la desalación. Las aguas usadas de las calderas y camaras de secado son echadas en una laguna de infiltración al lado de Rio Chico, son aproximadamente de 100 litros por día. El agua de las secadoras se infiltran en un pozo especial, es consistente y verde, pero afirman que no contiene substancias pelogrosas. Solamente contiene substancias de la madera, no de la corteza. Hay pruebas de riego de troncos. Madera en troncos se mancha en 2-7 dias, son atacados por hongos entre 60-30% de humedad. En la prueba, riegan por 40 dias con buen resultado. El agua del riego viene de Rio Chico, y desagua a las lagunas de infiltración, no entra directamente al rio. El riego necesita bastante agua. Los químicos de la corteza probablemente desalan en concentraciónes tan bajas que no son peligrosas, pero no se hizó prueba alguna. La basura del logemiento la entierran. Otros residuos ponen en un pilo, a veces mandan un detail de maquina que no funccióna a Santa Cruz para saber allá que necesitan en cambio. Entre la planta y Rio Chico y, en el curso del rio hay residuos de madera, metal y plastico.

Impactos a la Flora, Fauna y Biodiversidad

De las especies con resina tóxica, ochoo es lo más tóxico y mata a peces, por eso lo aserrran durante la época seca. No hay observaciónes de peces muertos en el rio. Impactos al alrededores del aserradero no son grandes. Animales como insectos y pajaros visitan el área. El ruido del aserradero y el generador es fuerte en el área de industria, pero en el bosque al rededor el ruido es más apagado.

Salud de Vecinos

En el pueblo Urubichá más bajo del curso del Rio Blanco, utilizán el agua del rio como agua potable, y tambien pezcan. En los logemientos de La Chonta tienen un pozo.

Manejo de Quimicos y Combustibles

Processan la madera lo más rapido posible, para minimizar la utilización de químicos como insecticidas y fungicidas. No cortan durante la lluvia, por evitar ataques de hongos a la madera. Actualmente no utilizan químicos, y entonces no hay emisiones al agua. El transporte se hace con tractores y camiones a diesel. Los caminos en el bosque son malos. Con mejores caminos el transporte sería más eficáz y resultaria menos la contaminación por los gases que producen estas máquinas, y con cargas más grandes se reduciría las distancias. La madera que es secada en el sitio de explotación pesa la mitad para transportar a la ciudad, y por tal consecuencia van a doblar la capacidad de los secadores en La Chonta. Hay rutinas para el manejo de combustibles, pero los encargados no saben si los obreros siguen los rutinas establecidas, podría ocurrir derrames de combustibles durante su traslado del almacen al generador. El aceite usadado de los camiones, 15 litros por mes, reutilizan el 60% para la lubricación de cadenas de motosierras, mientras el 40% lo echan en una fosa.

Ambiente Laboral y Seguridad Industrial

Se hizó una investigación de ambiente laboral y seguridad industrial (Beijar, 1999). Contiene algunas recommendaciónes, pero el aserradero y la carpinteria estan en un proceso de reorganización y, por eso algunas de estas no son implementables. El aserradero esta situado bajo un techo sin paredes, tiene extracción de aserrin, pero se acumula. La fábrica carece de planificación y por eso es difícil de limpiar. La linea será mejorada, y el aserradero será más facil de limpiar con el nuevo orden.

Los obreros del aserradero no quieren usar protectores contra el ruído. El equipo de cortadores usan cascos, pero no proctectores contra el ruído. La sierra nueva que tiene puntas de estellite, corta más rapido con menos ruído. El generador también hace mucho ruído, pero no hay mesuras de decibel en los logemientos. Un problema con ropa de protección es que los obreros las venden en lugar de utilizarlas.

No hay illuminación local para las máquinas del aserradero, ésta se la utilizan más en la carpinteria donde trabajan con detalles. El aserradero tiene amplios espacios de trabajo, y la iluminación general es sufficiente. La central eléctrica sera separado del área de trabajo. La gente sabe manejar las máquinas, pero a veces es más facil hacer algo de un modo incorrecto. Lavan sus manos con gasolina aunque no lo deben hacer, porque es más rápido que lavar con jabón. Fuman en los espacios laborales aunque esta prohibido por el riesgo de incendios. No hay equipo ergonómico en Bolivia y su importación es demasiada costosa.

No hay preparación formal contra accidentes, no ocurren muchas accidentes en el bosque. En el aserradero, el riesgo mayor es accidentes a los obreros. Los encargados estan capacitados en primeros auxilios. Los incendios también son un riesgo considerable, la maestranza se incendió el año pasado. Tienen bomba contra incendios en el aserradero, es solamente un tanque de agua que funcióna con presión de su elevación. Controlan el volumen del agua en el tanque casi todos los dias.

4.3 Impactos de la Carpinteria

- Ruido
- Humo
- Ceniza
- Manejo de la basura sólida
- Utilización de químicos: biocidas, solventes
- Manejo de aceite y combustibles
- Ambiente laboral: ergonomia, aserrin, limpieza, ruido, ropa de protección, higiene
- Accidentes del personal, incendios

Impactos al Suelo, Agua y Aire

La carpinteria no tiene ambiente sensible al rededor y, tampoco generan mucha emisiónes. Hay humo de las calderas. No hay residuos maderables de la carpinteria: la madera queman para energia y el aserrin lo comercializan. Hay ideas de utilizar el aserrín como combustible, pero entonces tendrian que cambiar la dirección de toda el sistema de extracción. La ceniza es depositada en el camino de la planta para mejorarlo en estabilizar la arena. Los residuos sólidos son esterrados en una fosa.

Salud de Vecinos

La carpinteria esta situada en una zona industrial, pero construyen urbanizaciónes más y más cerca de ésta, ya que esto podrá ser un problema en el futuro. El ruido no es un problema actualmente para los vecinos, las máquinas no son tan ruidosas, estan situadas en un edificio y todavia hay muco espacio al alrededor de la carpinteria. El humo podría ser un problema, es posible comprar filtros, pero son costosos.

Manejo de Quimicos y Combustibles

En el almanecen utilizán insecticidas biodegradables. Un solo empleado esta encargado del manejo de los químicos, él esta capacitado en seguridad personal y utiliza ropa de protección. Para la exportación tienen que fumigar los contenedores con fosforo de aluminio. Sobre la laca y el barniz, tienen poca información de sus contenidos. Solventes pueden ser toluen, alcohol y derivados del petroleo etc. La pintura tiene ventilación para mejorar el ambiente laboral, y entonces los solventes contaminan el aire. No tienen conocimiento si los pigmentos de los tintes contienen cadmium. Los combustibles que utilizán durante el mes lo depositán en un almacén. Hay rutinas para su manejo.

Ambiente Laboral y Seguridad Industrial

Los impactos mayores en la carpinteria son el ruido y el aserrín. Estan construyendo un sistema de extracción con silos para el aserrín. Parte de éste proyecto esta cumplido. Tenian empleados para la limpieza antes, pero ahora no. Los obreros tienen que limpiar, pero así los jefes exigen que obreros trabajen en la producción hasta el último minuto del turno. Realizán ahora más trabajo con menos personal que hace dos años atrás.

Se tenía previsto la visita de una enfermera una vez por semana, para hacer un estudio de ergonomia y protección como mascaras de polvo etc., pero solo vino una vez. Han

implementado las recommendaciónes que hizo. Algunos de los obreros utilizán protectores contra el ruído y mascaras contra el polvo. Hay cursos de capacitación por las empresas que venden equipos de seguridad industrial. Un uniforme de trabajo será introducido el próximo año, subencionado una parte por la empresa y la otra parte financiado por los mismos empleados.

No hay preparación formal contra accidentes. El análisis de riesgos no esta documentado. En la carpinteria, los incendios son los riesgos mayores. No ocurren muchos accidentes, y no tan graves como puede ocurrir en el aserradero. Hay capacitación de prevención contra accidentes. Hay documentación sobre accidentes, el responsable del personal tiene este registro. No documentan amagos de accidente. No hay rutinas para utilizar información sobre accidentes, apesar de esas deficiencias tratan de mejorar la seguridad.

German Tabura es supervisor de protección contra incendios. Todos son responsables de que el equipo funcione y que el personal utilizé protección. Hay alarma, y un tanque de agua con puntos hidrantes. El sistema para apagar incendios esta sobredimencionada. La empresa da cursos para prevenir incendios. No hay mucha documentación. El riesgo es mayor con madera seca, especies inflamables y viento. Hay reglas, por ejemplo cuando trabajan con soldura deberían tener equipos al alcance de la mano para apagar incendios. Hay personal de salvación, pero los otros no saben que hacer en caso de accidente.

5. Discusión

5.1 Consideraciónes Ambientales

Hay varios incentivos para el trabajo en aspectos ambientales. Mejorar la seguridad laboral y evitar accidentes, también es mejorar la producción, se evita de tal manera los costos para capacitar otra persona que remplace a alguien que ha tenido un accidente. Controlar el manejo de residuos y emisiones es responder por la salud de sus vecinos. Las consideraciónes ecológicas beneficarán a la empresa a largo plazo, como en la diversificación de la producción. El mercado compra madera certificada de varias especies, no solamente mara, que ya es sobreexplotada y empieza a acabarse. Con una práctica ambiental progresiva, la empresa evitará tener problemas con las autoridades en el futuro, cuando las leyes empiecen a ser aplicadas.

Impactos al medio ambiente también son relacionados la productividad y a la calidad de productos. Para potenciar el rendimiento del bosque aprovechado y, minimizar el impacto, se debe mejorar el rendimiento del aserradero, que ahora es del 35-45%, podría ser del 60-70%. De las bordas, 40% seran productos finales. El rendimiento podria ser aumentada con corta adaptada, con entrada más rápida a las secadoras y con irrigación de la madera. Supervisión automatizada del secado pudría reducir torcidos y fisuras en la madera, también sería posible cortar bordas más delgadas y reducir los residuos. Finalmente, el rendimiento de la carpinteria también pudría ser mejorada con mejor calidad de la madera.

5.2 Capacitación

Se llega a las metas con capacitación. Hay cursos para los administradores, ahora realizarán un curso en la UPSA, de producción y tecnología. Las evaluaciónes consultarias también son

una ocasión para la capacitación. Tambien hay capacitación para los encargados de operaciónes forestales y aprovechamiento, también para los operadores de máquinas. No hay capacitación formal para el resto del personal. No hay capacitación formal para manejar maquinas; los obreros nuevos son ayudantes por 1-2 meses, aprenden observando a el operador. La rotación del personal es un problema, pero esta disminuyendo, en relación a otras empresas parecidas. La administración es casi permanente. Cerca del 10% es totatorio por año en la fabrica, y en el aserradero solo tienen empleados de temporada.

5.3 Concluciónes y Recommendaciónes

Bosque

El bosque parece ser bien manejado y supervisado con respecto al medio ambiente, y es certificado en acuerdo con las criterios de FSC. Prácticas de tala parecen estar adecuadas, ya que algunos impactos son inevitables a los árboles del alrededor, a la flora y fauna. El impacto más considerable es el cambio en la composición de especies a largo plazo. Es de interés investigar los impactos a la biodiversidad, como en las investigaciónes de L. Quevedo. Investigaciónes de enriquecimiento tambien podria ser valuables.

Los indigenas no entran al área de concesión, donde tienen otorgado el derecho a la caza. Una questión de interés saber si no tienen la possibilidad actual para utilizar su derecho formal, o por que no lo utilizan.

Aserradero

Se puede compostar o quemar residuos de madera, aserrín y corteza. Ambos procedimientos liberan CO2 al aire. Si se quema madera, es mejor hacerlo en una caldera que en una hoguera, por que esto resulta en combustión incompleta que es dañino al medio ambiente. Quemar madera para energia es mejor que utilizar recursos fosiles de energia. Un inverción en una turbina de vapor reducirá la demanda de combustibles, y también la demanda de areas de depositación.

La ceniza es un recurso como fertilizante. La ceniza seca consiste de oxidos de alta pH que “quema” el suelo si se aplican directamente. Menos de 3 tons de ceniza por hectar no es dañino. Los tratados con agua, los oxidos se convierten en hydroxidos, que estabilizan a los carbonatos en contacto con el aire. Una técnica nueva para producir fertilisante es la solidificación de la ceniza húmeda, para producir granulatos de buena calidad. La reutilización de la ceniza en la producción forestal es más valuable donde la perdida de nutrientes es mayor. Para servir como fertilizante, la ceniza tiene que consistir solamente de residuos de madera.

El aceite usado es echado en una fosa, que es dañino al agua subterránea. Es mejor quemar el aceite. Parte del aceite es utilizado para lubricar las cadenas de las motosierras y, entonces es dispersado en el bosque. A largo plazo sería mejor buscar lubricantes menos dañinos. Además, hay rutinas para el manejo de combustibles, pero hace falta un control para saber si los obreros ponen en práctica las rutinas establecidas.

La irrigación de troncos podría ser más precisa con un sistema para medir la humedad, y la demanda de agua para el riego sería reducida con la recirculación del agua. Se podría

descargar las lagunas de infiltración y depositar los sedimentos. Se podría hacer estudios de las lagunas durante las inundaciónes, si hay desalación de tanninos en la epoca de lluvia, y si los peces son afectados por la resina de ochoo.

Para reducir el ruido del generador electrico, se puede construir una muralla contra el ruido, situarlo el generador en un edificio, o lo mejor en el aspecto de ruido, colocarlo el generador en una fosa, asi el ruido sería dirigido hacia arriba.

Carpinteria

Los impactos ambientales de la carpinteria principalmente se refiere al ambiente laboral, y podría ser mejorado con capacitación, por ejemplo seguridad personal para los obreros, preparación contra accidentes, seguridad en caso de incendios, utilización de ropa para protección etc. La administración podría mejorar la documentación sobre los accidentes y amagos, y hacer un analisis de riesgos. Los impactos al enrededores incluyen emisión de solventes. Un sistema cerrado para el taller de pintura, que ahora es una parte menor de la producción, es una inversión muy cara. Tambien hay emisión de humo de las calderas, que podria ser reducidos con un filtro, o mejorarando en método de combustión. Una meta ambiental a largo plazo podría ser la reducción de estos impactos.

Organización

Al respecto de la organización, mi propuesta es que La Chonta elaboré un sistema de gestión ambiental en acuerdo con el sistema de ISO 14 000, sin poner certificación como su meta principal, pero solo para desarollar el sistema. La empresa podria crear una política ambiental, y establecer metas ambientales para todas sus actividades y revisiones periódicas. De tal manera se podría mostrar si las metas son logradas ó no. Èsta política podría considerar las questiónes de el medio ambiente; que se debería hacer? quien lo haría? y la evaluación de los costos? Las revisiones podrían dar las respuestas de los hechos actuales y como funccióna. Un sistema de gestión ambiental posibilitará el mejoramiento ambiental en breve y a largo plazo, y incluirá tanto inversiónes grandes y costosas, como medidas de mitigación contra impactos ambientales menores y menos considerables.